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مقاطع فيديوهات لشرح المقرر بشكل وافي
ملخص للمادة Pdf للمذكرة والمراجعة
محاضرات مباشرة علي برنامج زووم
لمناقشة الأجزاء الغير مفهومة
تواصل مستمر مع معلم المادة
للتواصل
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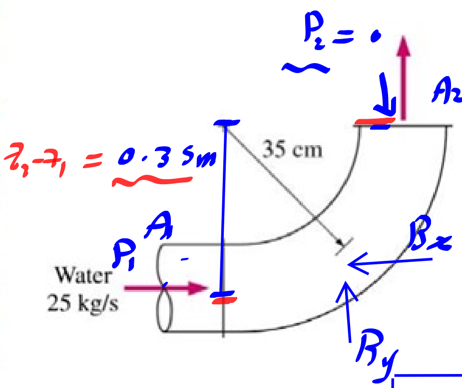
A 90° elbow is used to direct water flow at a rate of $0.025 m^3/s$ in a horizontal pipe upward. The diameter of the entire elbow is 10cm. The elbow discharges water into the atmosphere, and thus the pressure at the exit is the local atmospheric pressure. The elevation difference between the centers of the exit and the inlet of the elbow is 35 cm. The weight of the elbow and the water in it is considered to be negligible. Take the momentum-flux correction factor to be 1.03. Determine (a) the gage pressure at the center of the inlet of the elbow and (b) the anchoring force needed to hold the elbow in place.

kg/s = $\dot{m}$



$A_1 = A_2$

$V_1 = V_2$

$Q = A_1 \cdot V_1 = A_2 V_2$

$$\frac{P}{\gamma} + \frac{V^2}{2g} + z = C$$

$$\Sigma F = \rho Q \beta (V_2 - V_1)$$

$Q = A \cdot V$

$$V = \frac{Q}{A} = \frac{0.025}{7.85 \times 10^{-3}}$$

$V = 3.18 \ m/s$

$Q = 0.025 m^3/s$

$P_2 = 0 \quad , \quad A = \pi \frac{d^2}{4} = \pi \frac{0.1^2}{4} = 7.85 \times 10^{-3} \ m^2$

$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + (z_2 - z_1)$$

$$\frac{P_1}{\gamma \ (\rho g)} = z_2 - z_1 \Rightarrow P_1 = 1000 \times 9.81 \times 0.35 = 3433.5 Pa$$

$$\Sigma F_x = P_1 A_1 - B_x = 1000 \times 0.025 \times 1.03 (0 - V_1)$$

$$3433.5 \times 7.85 \times 10^{-3} - 1000 \times 0.025 \times 1.03 (-3.18) = B_x$$

$B_x = 108.8 \ N$

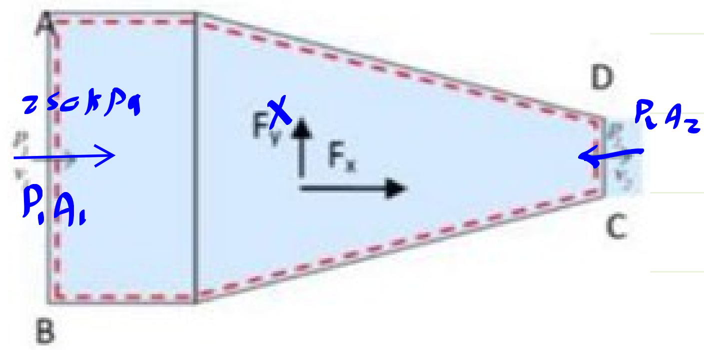
$$\Sigma F_y = B_y = 1000 \times 0.025 \times 1.03 (3.18)$$

$B_y = 81.88 \ N$

$$B = \sqrt{108.8^2 + 81.88^2} = 136.17 \ N \ , \ \theta = \tan^{-1}\left(\frac{81.88}{108.8}\right) = 37°$$

Question 2

A water jet is used at a carwash is created by connecting a nozzle to a hose as shown in the figure below. The pressure at the inlet is 250 KPa and the flow rate is 1.0 L/s. The inlet diameter is 25 mm and the exit diameter is 10 mm. Determine the anchoring force required to old the nozzle in place.



$P = 250 * 10^{3}\, Pa$, $Q = 1 * 10^{-3}\, m^3/s$, $d_1 = 0.025\, m$

$d_2 = 10 * 10^{-3}\, m$

$$\Sigma f_x = P_1 A_1 + f_x - P_2 A_2 = \rho Q \beta (V_2 - V_1)$$

$250 * 10^3 * \pi \frac{0.025^2}{4} + f_x - 171 * 10^3 * \pi \left(\frac{10 * 10^{-3}}{4}\right)$

$= 1000 * 10^{-3} (12.73 - 2.037)$

$f = -98.6\, N$

$Q = A \cdot V \Rightarrow V = \frac{Q}{A}$

$V_1 = \frac{Q}{A_1} = \frac{10^{-3}}{\pi \left(\frac{0.025^2}{4}\right)}$

$V_1 = 2.037\, m/s$

$V_2 = \frac{10^{-3}}{\pi \left(\frac{(10 * 10^{-3})^2}{4}\right)}$

$V_2 = 12.73\, m/s$

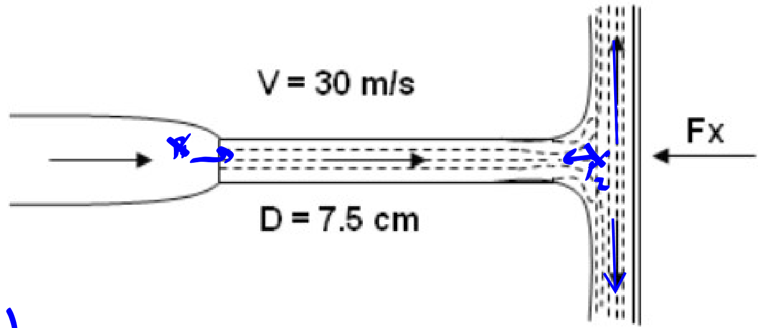
$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + z_2$$

$$\frac{250 * 10^3}{1000 * 9.81} + \frac{2.037^2}{2 * 9.81} = \frac{P_2}{1000 * 9.81} + \frac{12.73^2}{2 * 9.81}$$

$P_2 = 171\, kPa$

Question 3

A jet of water strikes a stationary flat plate perpendicularly, if the jet diameter is 7.5 cm and its velocity upon impact is 30 m/s, determine the force, Fx, required to hold the plate in place neglecting frictional losses.



$Q = A \cdot V$

$\pi \frac{(7.5 \times 10^{-2})^2}{4} \times 30$

$\Sigma F_x = -F_x = \rho Q (V_2 - V_1)$

$F_x = \rho Q V_1 = 1000 \times \pi \frac{(7.5 \times 10^{-2})^2}{4} \times 30 \times 30$

$F_x = 3976 N$

$\rho A \cdot V_1 V_1$

$\rho A V^2 (1 - \cos\theta)$